Pokagon State Park – Pond Reclamation

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INTRODUCTION

In the late 1930s and early 40s, the Civilian Conservation Corps (CCC) worked in Pokagon State Park and built many of the existing structures. Included in their work at the park was the construction of three fishery ponds that were intended to raise fish for nearby Lake James. Over time, the vegetation in the area grew rapidly, and without annual maintenance, the site became overgrown and unrecognizable. Each year all three ponds fill with water from snowmelt and springtime rainfall, but by the end of the summer the ponds are almost completely dry. The park wishes to restore these ponds to their original condition through a complete analysis and redesign of the site. These ponds are located just north of the Potawatomi Inn and have great potential to host a serene and thriving ecosystem again.

SCOPE OF WORK

The work conducted for this project consisted of preliminary field work, laboratory testing, structural analysis, hydraulic analysis, and construction design. As previously stated, these ponds dry up each year. The client informed us that this is acceptable if the design for a "permanent" pond system is too intensive and/or expensive. We completed designs for both a seasonal and a permanent pond system.

FIELD WORK

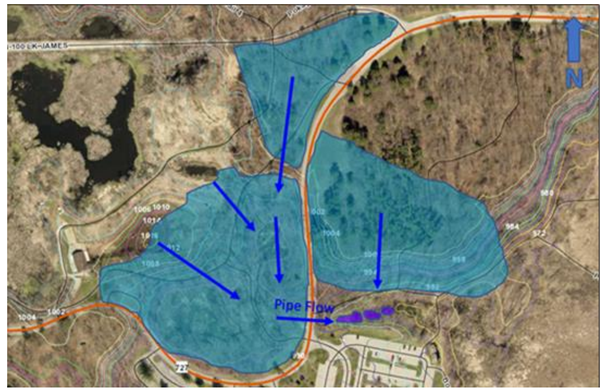
The field work for this project included vegetation clearing, topographic surveying, performing soil borings, water tracing, and water quality testing. The land needed to be cleared initially to allow for proper topographic surveying. The data from the survey was used to create a topographic map of the site that included the locations of existing structures and path. After the survey, we were able to perform soil borings and collect soil samples from the boring locations. These soil samples were transported to Trine University's soil laboratory and multiple tests were completed to classify the soils. The soil samples from the bottoms of the ponds were classified as clayey soils, which are ideal for retaining water. The soil surrounding the ponds is a poorly graded sand, which does not effectively hold water. The next phase of field work was to determine the source of water for the ponds. In the spring of 2021, we observed water in the ponds for the first time following spring snow melt. We poured an environmentally friendly, fluorescent green tracing dye into an existing catch basin located west of the ponds. After about 25 minutes, the dye was seen flowing into the ponds from the existing pipe system, which confirmed the western basin to be the source of water. In addition, we collected and tested water samples from the ponds. Multiple tests were performed to determine the quality of the water and ultimately, the possibility of restoring the ponds as an aquatic habitat. The results are summarized in the Laboratory Testing section.

STRUCTURAL ANALYSIS

The client informed our team that they would like to add a pedestrian bridge to the site. The bridge will be installed over a channel that connects two of the ponds. Adding a bridge to the design adds aesthetic value as well as an opportunity for visitors to get a close view of the ponds. A prefabricated bridge was selected from a supply company, and we performed a complete structural analysis to ensure that it was safe.

HYDRAULIC ANALYSIS

The hydraulic analysis for this site was completed using the TR-55 method. This method allows the user to estimate peak runoff, time of concentration, and peak discharge from the drainage area. The 2-year 24-hour storm intensity was found from the Fort Wayne IDF curve. From the analysis, it was determined that the surface runoff and spring snowmelt is enough to initially fill the ponds, but the runoff is not consistent throughout the seasons and more water continuously leaves the system than enters. We believe that water leaves the ponds by evaporation and some seepage into the sandy pond banks. In addition, if the client wishes to have a permanent pond, we recommend an additional water source as described below.

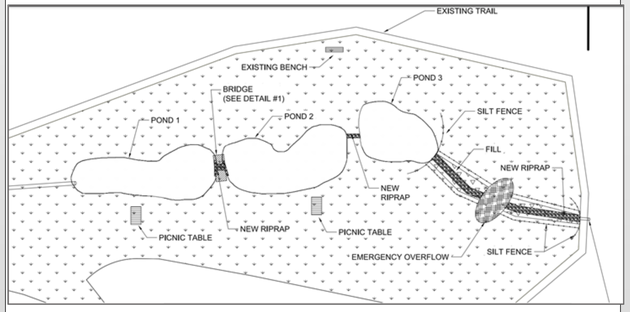


LABORATORY TESTING

Water samples were collected for the following tests: pH, hardness, dissolved oxygen, turbidity, iron, nitrate, phosphorus, and ammonia. Water samples were collected and tested from ponds 1 and 3, from within the catch basin and from the overland flow into the catch basin. The presence of iron in water may suggest that it is groundwater as opposed to surface runoff. High levels of iron were found within the catch basin and in pond 1. This may be due to iron leaching from the existing clay pipe system. There were no traces of nitrate found in the water samples from pond 1, while levels were seen in pond 3. This is reasonable, as nitrate forms in water bodies after the degradation and reaction of ammonia with naturally occurring nitrite bacteria. Traces of phosphorus and ammonia were found in the samples which was expected due to the horse stable upstream. Most of the tests yielded data that either fell within an acceptable range or was deemed acceptable after judging the effects on the ecosystem.

SEASONAL PONDS DESIGN

The current pond is seasonal but some improvements can be made. We recommend a realignment of the existing stone perimeter of each of the ponds, minor excavation, riprap installation, bridge and foundation installation, and picnic table installation. The excavation will consist of removing the existing pipes and headwalls between the ponds and removing 9 inches of organic matter and topsoil in each pond. The 9 inches will be excavated to expose the clay layer of soil and to prevent plant life from growing back in the pond bottoms. Riprap should be installed in the channel that connects the ponds to resist erosion. The bridge should be located between Ponds 1 and 2 as shown below. Two picnic tables will also be installed near the ponds for visitors' leisure. These ponds are expected to dry up in summer, so we do not recommend stocking the ponds with fish for this design.



PERMANENT PONDS DESIGN

For these ponds to hold water year round, additional water can be obtained from the adjacent artesian well. In addition, and HDPE liner could be installed to minimize seepage from the ponds into the banks. However addition soil testing is recommended to verify the need for a liner. An excavation of 9 feet is suggested for this design to provide adequate area for fish and to prevent winter kill. The permanent pond design shares some components of the seasonal pond design, such as the realignment of the stone perimeter, the bridge and foundation installation, and the picnic table installation. The main difference is the incorporation of fish and the measures to be taken to assure an appropriate ecosystem. We recommend stocking the pond with walleye fry in early spring and transporting them once they reach fingerling length in early summer.